UNITED
NATIONS

S

Security Council

Distr.
GENERAL

S/1995/1003
1 December 1995

ORIGINAL: ENGLISH

NOTE BY THE SECRETARY-GENERAL

The Secretary-General has the honour to transmit to the members of the Security Council the attached communication, which he has received from the Director General of the International Atomic Energy Agency (IAEA).

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Annex

Letter dated 24 November 1995 from the Director General of the International Atomic Energy Agency addressed to the Secretary-General

Please find attached the report of the twenty-eighth IAEA inspection in Iraq under Security Council resolution 687 (1991). You may deem it appropriate to transmit the report to the members of the Security Council.

I remain, of course, available, as does the Chief Inspector, Garry Dillon, for any consultations you or the Council may wish to have.

(Signed) Hans BLIX
Director General

Attachment

REPORT ON THE TWENTY-EIGHTH IAEA ON-SITE INSPECTION IN IRAQ UNDER SECURITY COUNCIL RESOLUTION 687 (1991)

9-20 September 1995

SALIENT POINTS

The objective of the twenty-eighth inspection mission was to follow up on verbal information provided by the Iraqi counterpart during the technical talks held in Baghdad, at the invitation of the Government of Iraq, from 17 to 20 August 1995. During these talks, the IAEA delegation had been advised inter alia that information regarding a crash programme, established in August/September 1990 to divert from IAEA safeguards the highly enriched uranium (HEU) material from the fuel of the French- and Russian-supplied reactors to Iraq's clandestine nuclear weapons programme, had been withheld from IAEA at the express instruction of Lt. General Hussein Kamel Hassan Al Majid, who had subsequently left Iraq on 8 August 1995. Discussions were held at the headquarters of the Military Industrialization Corporation with the principal scientists, engineers and support staff involved in this hitherto undeclared crash programme and a total of five facilities, installations and sites were visited.

According to the Iraqi counterpart, the crash programme had been planned to comprise tasks involving the reprocessing of both the unirradiated and irradiated fuel to recover the HEU, the re-enrichment of the 80 per cent enriched material of Russian origin, through the use of a 50-machine gas centrifuge cascade that was to have been specially constructed for the purpose and the conversion of the HEU chemical compounds to metal. The other activities, namely the casting and machining of the HEU to form the pit of a nuclear weapon, weaponization measures, including the fabrication of the implosion package, and the selection and construction of a test site and/or delivery system were established activities of the Fourth Group and were stated to have been already moving ahead at the fastest possible rate.

The successful implementation of the crash programme would have resulted in Iraq being able to extract some 25 kilograms of HEU, with an average enrichment of 86 per cent from the fresh and lightly irradiated research reactor fuel by the end of April 1991. The extraction of the HEU from the irradiated research reactor fuel, being more problematic, was not likely to have been accomplished before the end of October 1991. The production of a nuclear weapon from the HEU would have been dependent upon the finalization of the design and the associated practical weaponization capabilities which, according to the Iraqi counterpart, would have made it impossible for them to have been in a position to deploy/test a single nuclear weapon/device before the end of 1992 (see note to para. 38).

It is now evident that a small-scale reprocessing plant had been designed, constructed, installed and commissioned in the hot cells of building 22 (LAMA) at the Iraqi Atomic Energy Commission (IAEC), Tuwaitha, and was ready to commence operation in January 1991. Iraq's past experience in laboratory-scale reprocessing had enabled the LAMA pilot plant to be commissioned rapidly but the picture with respect to the other components of the crash programme is not yet sufficiently clear to permit an accurate estimate to be made of the time that would have been required to achieve the overall objective of the crash programme.

As already established, in June 1991, on the basis of the accountancy measures undertaken by the first IAEA inspection mission to Iraq, none of the HEU material was diverted to weapons use.

It was declared that a review of the work of IAEC Directorate 3000 (PC-3) was undertaken in May 1987, resulting the establishment of three groups:

(a) First Group: to continue development of gaseous diffusion technology;

(b) Second Group: to continue development of electromagnetic isotope separation technology (EMIS);

(c) Third Group: to provide engineering and technical support.

At the same time, a working group was established in the office of the Minister of Industry and Military Industrialization to define the specific requirements for Iraq's nuclear weapons programme.

It was also acknowledged that, in 1987, a unit had been established at Al Qaqaa (a State establishment under the control of the Minister of Industry and Military Industrialization) to carry out a programme of development and testing of high-explosive lenses for an implosion device. Although the Fourth Group (Weaponization) was established within PC-3 in 1988 it was not until early 1990 that their interaction with the Al Qaqaa unit became formalized.

For the first time it was acknowledged by Iraq that the activities carried out by the Fourth Group, initially at IAEC, Tuwaitha, and later in Al Atheer, were for the direct purpose of producing nuclear weapons and not as previously asserted merely to define, through studies and experimentation, the necessary capabilities that would have been required in the event of a political decision to embark upon the production of nuclear weapons.

Credible descriptions were obtained as to the purpose and utilization of the main buildings at the Al Atheer site, with particular respect to the internal explosion chamber (building 18) and the gas gun laboratory (building 21).

An admission was gained as to the processing of undeclared nuclear material in the former Fuel Fabrication Laboratory (Tuwaitha building 73),

whereby it is now evident that some 10.3 tons of natural uranium comprising uranium dioxide of Brazilian origin and yellowcake of indigenous origin (Akashat/Al Qaim) was processed therein (see annex III).

Although new information was obtained regarding domestic transfers of nuclear material there are no current indications that would significantly affect the IAEA evaluation of the total inventory of nuclear material.

The Iraqi counterparts finally admitted that the Engineering Design Centre (Rashdiya) was the headquarters of the centrifuge enrichment project and provided a detailed explanation of its establishment, building utilization and achievements, but could offer no convincing rationale for their continued concealment of this fact even after the series of high-level technical tasks that began in mid-1993.

There is no evidence of practical progress towards the establishment of the 50-machine centrifuge enrichment cascade, although it appears that foreign assistance was to have been relied upon for the procurement or production of the carbon fibre cylinder components of the rotor assemblies.

Wide-ranging information was obtained that provided clarification and confirmation regarding aspects of the procurement system established to support the centrifuge enrichment project.

There are no indications to suggest that Iraq has retained any practical indigenous capability to produce weapons-usable nuclear material. However, had the crash programme been implemented, it could have provided enough material for a nuclear device in a shorter time than would have been necessary through Iraq's covert programme to enrich natural uranium. It is recognized that Iraq's intellectual capabilities and resources in this regard remain.

In discussion, the Iraqi counterparts were forthcoming to an unprecedented degree and demonstrated an apparent sense of relief at being able to talk about matters that they had previously either denied or for which they had persisted to defend explanations of highly questionable credibility. The Iraqi counterparts had clearly made significant efforts to make available not only the various previously recognized task leaders but also large numbers of scientific and technical support staff. There were however indications of reticence typified by their continued understatement of the competence of the management of Iraq's clandestine nuclear weapons programme and the capabilities of its cadre of talented and highly educated scientists and engineers. A specific example of this reticence is their insistence that no project plan existed for the crash programme, despite the fact that the programme must have been considered to be of extremely high priority by its alleged initiator, the then Minister of Industry and Military Industrialization, Lt. General Hussein Kamel Hassan Al Majid.

A number of significant technical documents relating to the former nuclear weapons programmes were provided to the IAEA team by the Iraqi counterparts in the course of the inspection mission although, in some cases, the hand-over was inexplicably delayed towards the end of the inspection mission. These documents, one of which described nuclear weapon design options, are being translated to facilitate urgent detailed evaluation. 1/

I. INTRODUCTION

1. The present report summarizes the results of the twenty-eighth on-site inspection carried out in Iraq by IAEA under Security Council resolution 687 (1991), with the assistance and cooperation of the United Nations Special Commission. The inspection took place from 9 to 20 September 1995 and was led by Garry Dillon of IAEA as Chief Inspector. The team consisted of 15 inspectors, comprising 8 nationalities.

2. The objective of the inspection was to investigate and document the details of an Iraqi crash programme that had been established in August/September 1990 with the purpose of accelerating the production of a nuclear weapon by diverting the safeguarded highly enriched uranium (HEU) contained in the fuel of the French- and Russian-supplied research reactors. The implementation of this crash programme, if successful, would have reduced the time required to attain sufficient nuclear material for a single nuclear weapon by up to two years compared to the probable production time-scale of Iraq's EMIS and centrifuge enrichment programmes.

3. The crash programme, ostensibly initiated by Lt. General Hussein Kamel and managed, at his instruction, by Dr. Jaffar Dhia Jaffar, was described by the Iraqi counterpart to involve the following stages:

(a) Project 601, involving, in its first stage, the design, construction, installation and commissioning of a small-scale reprocessing plant in the Tuwaitha LAMA facility (building 22) and subsequently its use to reprocess both the unirradiated and the irradiated fuel of the research reactors to recover the HEU in the form of aqueous solutions of uranyl nitrate;

(b) Project 602, involving the conversion of the recovered HEU to metal;

(c) A sub-set of project 602, involving the design, fabrication and commissioning of a 50-machine centrifuge cascade at the Engineering Design Centre (Rashdiya) and its use to re-enrich the HEU recovered from the 80 per cent enriched fuel of Russian origin;

(d) Other related tasks involving:

(i) The casting and machining of the nuclear weapon pit from the HEU metal;

(ii) Weaponization measures, including the design and fabrication of the implosion package;

(iii) The selection and construction of a test site;

(iv) The design, fabrication and commissioning of a deliverable weapon;

were explained to be tasks of the Fourth Group, the preparation for which was already progressing at the fastest possible pace.

4. According to the Iraqi counterparts, only the first part of project 601 had been completed when all activities were brought to a halt by the bombing of Tuwaitha on 17 January 1991.

5. In the course of the IAEA-28 inspection mission, a series of meetings was held mainly at the headquarters of the Military Industrialization Corporation, but also at the principal facilities involved in the past nuclear programme namely: Tuwaitha, Al Qaqaa, Al Atheer and the Engineering Design Centre (Rashdiya). The following sections record the information obtained during these meetings and facility inspections, with respect to the above-listed stages of the crash programme and related activities.

II. ESTABLISHMENT OF REPROCESSING CAPABILITIES - PROJECT 601

6. According to the Iraqi counterparts, the hot cells of the LAMA facility at the Tuwaitha site, which had been previously used for the handling of radioactive materials, were selected to house the uranium recovery pilot plant, and work commenced on its design, construction and commissioning in September 1990. The experience gained by the assigned group from its earlier work, in the radiochemical laboratory (building 9), on the small-scale reprocessing of irradiated natural uranium fuel for the separation of plutonium greatly facilitated the task. By the end of 1990 they had decontaminated the LAMA hot cells, designed, fabricated and installed the plant components in the cells and had commissioned the plant by the dissolution of a "dummy" fuel element fabricated from aluminium and by the processing of natural uranium solutions synthesized to model the solutions that would result from the dissolution of the HEU fuel elements.

7. It was stated that Minister Hussein Kamel had been advised of the state of readiness of the LAMA reprocessing capability and his final approval to proceed had been requested. 2/ The documentation, relating to project 601, provided by the Iraqi counterparts during the August 1995 discussions, appear to support the claim that an adequate pilot-scale reprocessing capability had been installed and commissioned in the LAMA hot cells. It was also stated that the equipment had been removed from the LAMA hot cells following the air strikes on Tuwaitha, which had caused the destruction of the building, and that the principal components of the pilot plant had been destroyed to remove evidence of the project.

8. Verification activities carried out in May 1991, during the first IAEA inspection mission to Iraq under Security Council resolution 687 (1991) satisfactorily accounted for all of the nuclear material subject to safeguards under the agreement between Iraq and IAEA (INFCIRC/172). Much of the material had however been removed from its normal storage location in the respective research reactor buildings and the Iraqi counterparts had explained that that action had been taken with the objective of preventing the spread of contamination caused by air strikes on the research reactor buildings.

III. PREPARATIONS FOR THE MELTING, CASTING AND MACHINING OF HIGHLY ENRICHED URANIUM - PROJECT 602

9. As previously established, considerable experience had been gained in the late 1980s within the PC-3 project, on the reduction of natural uranium tetra-fluoride to metal in lots ranging from 50 grams to more than 1 kilogram in the form of disc, derby and ingot. In keeping with Iraq's former position that the political decision had not been made to proceed to the design, development and production of nuclear weapons, the purpose of this work had previously been explained as technological development with the long-term possibility of converting to metal the depleted uranium, expected to result from Iraq's indigenous enrichment processes, as part of a waste management strategy. An additional declared use of the technology was the production of uranium penetrator bullets in response to a request from the Iraqi army.

10. However, during the August 1995 discussions, it was newly declared by the Iraqi counterparts that the small discs of 50 to 100 g mass were produced to test the process planned to be used for the reduction of the HEU material that was to have been recovered through project 601. Much discussion centred on the choice of such a small batch size for the HEU reductions, since most of Iraq's experience was with batch sizes of the order of 1 kg. The Iraqi counterparts offered two explanations. One explanation was that the choice of the small batch size minimized the losses in the event that a reduction went drastically wrong and the other explanation was their concern for "criticality safety". Neither explanation seems to be particularly credible but no sinister interpretation is evident.

11. The complementary work on the melting casting and machining of uranium metal was discussed at length. It had already been established that, in addition to the casting of the rods for the uranium penetrator bullets, a sphere of approximately 5-centimetre diameter had been cast. During the current discussions, the Iraqi counterparts retracted their previous explanation that the sphere had been cast merely to optimize the mass-to-surface area ratio in connection with their work on melting and purification and declared that the casting of the sphere had been done to gain some preliminary experience that would be of assistance in their eventual production of the pits of nuclear weapons.

12. The Iraqi counterparts also confirmed that a small number (three or four) of hemispheres had been cast, although their quality was considered to be very poor, and that a similar number of spheres of 2-centimetre diameter had been cast. All of these uranium metal castings had been accumulated in Tuwaitha, after the outbreak of the Gulf war and had been dissolved in nitric acid to prevent their discovery by inspectors.

13. It was also established that the uranium metal casting activities, along with the associated equipment, had been transferred from Tuwaitha building 10 to Al Atheer building 85 in 1989 and that, of the total of 14 uranium penetrator bullets produced, approximately half were cast and machined in Al Atheer. This situation is a contradiction of Iraq's previous statement that no nuclear material was ever transferred to the Al Atheer site.

14. Another item of significance related to the processing of natural uranium was the admission by the Iraqi counterpart that the main process areas of the former Fuel Fabrication Laboratory (building 73) at Tuwaitha had been used for processing Brazilian origin UO_2, Iraqi origin UO_2 (Al Jezira) and Iraqi origin UO_4 (Al Qaim). In total 10.3 tons uranium equivalent were processed to produce UO_2, UF_4, U metal and other uranium oxides and uranium containing wastes. It is a matter of record that IAEA has, on a number of occasions, challenged the Iraqi counterparts that that facility had been used to process considerable amounts of nuclear material that should have been declared to IAEA in accordance with article 43 of the Safeguards Agreement.

IV. THE CENTRIFUGE ENRICHMENT PROGRAMME

15. As mentioned in paragraph 3, the crash programme, as described in the August talks, foresaw the use of a purpose-built 50-machine centrifuge enrichment cascade to further enrich the uranium that was to have been recovered from the 80 per cent enriched research reactor fuel of Russian origin. According to the Iraqi counterparts, this centrifuge cascade was never built, although the design concept was established and space had been allocated in hall B of the Engineering Design Centre (Rashdiya). No evidence was found to contradict this statement, although the Iraqi counterpart was confident that the task could have been accomplished and that outside expert assistance would have been readily available to help in the manufacture or procurement of such critical items as the carbon fibre cylinders for the centrifuge rotors.

16. Considerable discussion took place on the admission by the Iraqi counterparts, during the August 1995 talks, that the seat of the centrifuge enrichment programme was, as long contended by IAEA, the facility known as Rashdiya. It was explained that, during a high-level programme review in May 1987, the PC-3 project was divided into three groups. The First Group was to continue work on the development of a gaseous diffusion uranium enrichment capability; the Second Group was to continue work on EMIS; and the Third Group was to provide engineering and technical support to the two development groups. At the time of this reorganization, the head of the First Group had expressed his conviction that, although considerable promise of success was evident in the production of diffusion barriers, the technological content of the entire gaseous diffusion process was likely to be beyond Iraq's short-term capabilities and had suggested that the gas centrifuge enrichment process was worthy of attention.

17. In August 1987, apparently as a result of this initiative, the First Group, comprising some 230 IAEC personnel, was administratively transferred from the PC-3 project and placed under the direct supervision of the then Minister of Industry and Military Industrialization, Lt. General Hussein Kamel and was given the additional task of developing a gas centrifuge enrichment capability. At the same time it was decided to relocate the First Group geographically and shortly thereafter staff and equipment of the First Group were transferred to a defunct facility (the former Water Research Centre close to the Tigris North Bridge, Baghdad), which was renamed as the Engineering Design Centre.

18. Although the physical transfer of equipment and materials, including natural uranium in the form of UO_2, UF_4 and UF_6 had extended into 1988, the First Group had by the end of 1987 modified an existing building at the Engineering Design Centre and, using published designs dating back to the "Manhattan Project", had constructed and test-run an oil-bearing centrifuge of the "Beams" type.

19. In the course of 1988, the First Group secured assistance from foreign experts in the design and fabrication of gas centrifuge machines and had, with this assistance, progressed from oil-bearing to magnetic-bearing technology. Work on this technology continued through 1989, during which year they had designed and let contracts for the construction of the four principal buildings of the Al Furat centrifuge fabrication facility. The First Group had also, at a lower priority, continued its work in gaseous diffusion technology and had developed the capability to produce diffusion barrier tubes of anodized aluminium. This work was discontinued in 1989, as a result of the success achieved in the development of gas centrifuge enrichment technology.

20. By the middle of 1990, the First Group, with continued foreign assistance, had developed designs and had fabricated and tested a small series of prototype centrifuge machines incorporating carbon fibre rotors and magnetic bearings, the final version of which had a demonstrated capacity of the order of 2 kg separative work units (SWU) per year. According to the Iraqi counterparts, the original development programme had foreseen a series of some 50 prototypes before the design would have been finalized but, as it turned out, only 5 prototypes had been built before an acceptable version had been achieved.

21. Assuming that the separative capacity of the final development model could have been realized on a production basis, a cascade of 1,000 such machines, operating continuously, could have produced up to 10 to 15 kg HEU per year.

22. All the design and practical work had been accomplished at the Engineering Design Centre, 3/ including the production of additional kilogramme quantities of UF_6 used to measure the separation factors of the development models of the gas centrifuge machines. It was explained that the UF_6 had been produced from quantities of UF_4 obtained from the PC-3 project at Tuwaitha and that designs had already been finalized for a continuous flow UF_6 production pilot plant with a planned output of 1 kg UF_6 per hour.

23. It appeared that, in 1990, prior to the initiation of the crash programme, the First Group was already inclined to opt for carbon fibre as the material of choice for the cylinder of the gas centrifuge rotor. The Iraqi counterparts stated that, although they had made promising progress in the production of flow-formed cylinders from maraging steel, it was becoming evident that carbon fibre technology was preferable.

24. To this end, they had ordered a filament-winding machine and sufficient carbon fibre and epoxy resin for the production of 1,000 rotor cylinders and were arranging for Iraqi engineers and technicians to attend training courses abroad to gain experience in the use of the equipment. According to the Iraqi counterparts the embargo put into effect after their invasion of Kuwait

prevented the import of this equipment and material to Iraq and the related training of Iraqi personnel.

25. Towards the end of 1989 the head of the First Group was already anticipating delays in the completion of the building work at Al Furat, in particular the specialized building BO1 (assembly and testing of gas centrifuge machines - 100-machine cascade hall), whose construction and outfitting had been contracted to a foreign company. In order to avoid building delays from holding up the project, work was commenced on a building at the east end of the Engineering Design Centre campus similar to, though larger than, the 100-machine cascade hall included in the design of Al Furat building BO1. 4/ In the same time-frame, design concepts were established for project 1200, which was to have involved the construction of a facility south of Taji which would have included a UF_6 production plant and a hall for a 1,000-machine cascade.

26. At the time of the initiation of the crash programme it is likely that sufficient components, of foreign origin, were present in Iraq to permit the assembly of at least 5 centrifuge machines and, given some local success in the fabrication of end-caps and baffles, this number could have been increased to 20. Yet, surprisingly, during the five-month period ending in January 1991, they claim that none had been assembled. According to the Iraqi counterparts, they had elected to conserve the available components until they had accumulated enough to build the 50-machine cascade and use the intervening time to refine the design of the cascade to optimize it to the characteristics of the centrifuge machine.

27. Furthermore, the Iraqi counterparts were surprisingly vague about the design of the machine that would have been used for the 50-machine cascade and stated that the cascade would have been composed of a variety of centrifuge machine types, e.g. both axial magnetic bearings and radical magnetic bearings and both carbon fibre and maraging steel rotor cylinders, dependent upon the components available and the success of the various local manufacturing technologies.

28. A more credible explanation of the apparent nonchalance of the First Group in the absence of any practical progress towards the completion of the 50-machine cascade is that they had made arrangements to procure all the necessary components and expert assistance, through their extensive clandestine foreign supply network.

29. It was stated that all work ceased on the centrifuge enrichment project at the outbreak of the Gulf war and that at that time the Engineering Design Centre (Rashdiya) facility had been sanitized to remove all traces of its use in Iraq's clandestine nuclear programme and all materials, equipment and documentation had been transferred to temporary storage locations. In April 1991 much of the material, equipment and documentation had been recovered and brought back to the Engineering Design Centre, but shortly thereafter it was, as ordered, surrendered to the Special Guard of the Iraqi army. Follow-up action is planned to clarify what happened to this material.

30. In the discussions held on the centrifuge project, the Iraqi counterpart was forthcoming to an unprecedented degree and considerable detail was provided

to complement the information received during the twenty-second inspection mission in November 1993 as a follow-up to the high-level technical talks that were begun in July of that year.

31. Of significance in this regard was Iraq's declaration of the Engineering Design Centre (Rashdiya) as the seat of the centrifuge enrichment project and the extent to which information was provided with respect to the procurement system that had been set up to serve the centrifuge enrichment project. A few cases involved previously unknown transactions and will be further investigated.

32. Conversely, Iraq's inability to offer a rational explanation of its continued strategy of concealment of the Engineering Design Centre as the seat of the centrifuge enrichment project, even after the commencement of the high-level talks in July 1993, suggests that Iraq had hitherto elected to continue that strategy in order to protect, to the extent possible, this technological resource in order that it might be reconstituted at a future time. The apparent continued reluctance to volunteer information on additional sources of expert assistance beyond that previously declared to IAEA may also support that conclusion.

33. As this twenty-eighth inspection mission was undertaken concurrently with the indexing and categorization of the documentation received at the end of the August 1995 talks, only limited use could be made of their content to direct lines of investigation. However, preliminary indications are that, although the breadth of the programme in terms of additional facilities extends beyond Iraq's previous declarations, the stage of practical development of gas centrifuge enrichment technology appears to be consistent with the conclusions reached at the end of 1993 i.e. that Iraq had, with foreign assistance, produced a workable centrifuge design and was making good progress towards the establishment of a mass production capability. Further evaluation of the above-mentioned documentation will obviously be necessary before a final conclusion can be determined.

V. WEAPONIZATION

34. The discussions on this topic focused on the statements made by the Iraqi counterpart during the August talks with respect to the crash programme and in particular on the progress and achievements of the PC-3 Fourth Group (Weaponization) during the second half of 1990. In so doing, care was taken to try to distinguish between the then longer-term task of the Fourth Group, which was to build a nuclear weapons arsenal, and the immediate crash programme, aimed at a single explosive device. The Iraqi counterparts held to their statement at the August talks that no deadlines had been established for the Fourth Group with respect to the crash programme, but that they had been instructed to proceed to the programme goal of producing a nuclear weapon/device without delay.

35. The Iraqi counterparts confirmed the explanation, given during the August talks, that the Fourth Group had been created (in May 1988) as the result of a study carried out by a group of IAEC personnel, who had been seconded to the office of the Minister of Industry and Military Industrialization in 1987, and

tasked to define the resources, capabilities and timescale that would be required for Iraq's nuclear weapons programme.

36. For the first time it was acknowledged by Iraq that the activities carried out by the Fourth Group, initially at IAEC, Tuwaitha, and later at Al Atheer, were for the direct purpose of producing nuclear weapons and not as previously asserted merely to define, through studies and experimentation, the necessary capabilities that would have been required in the event of a political decision to embark upon the production of nuclear weapons.

37. Throughout the series of discussions, the Iraqi counterparts held to their statement that there had been no overall project schedule for the crash programme and that Project 601 (the recovery of HEU from the research reactor fuel) was the only component of the programme for which a deadline (April 1991) had been set.

38. The initial assessment of the Iraqi counterparts was that it would not have been possible to have assembled a nuclear weapon/device until 1994. In the course of questioning, this assessed time-scale was modified, but the Iraqi counterparts were firm in their view that, despite the fact that a sufficient amount of HEU would have been available before the end of 1991, the problems to be dealt with by the Fourth Group were such that the assembly of a nuclear weapon/devise would not have been possible before the end of 1992. 5/

39. The Iraqi counterparts repeated their statement, made at the August talks, that all weaponization activities had ceased at all facilities (primarily, Al Atheer, Tuwaitha, and Al Qaqaa) at the onset of the Gulf war (17 January 1991) and were never restarted. This statement is supported by the Al Atheer progress report, which was provided to the IAEA delegation during the August high-level technical talks. This 198-page report, dated 10 September 1991, covers the period from 1 June 1990 to 7 June 1991 and shows that the focus of activities after January 1991 was the salvage and off-site concealment of sensitive equipment and the sanitation of buildings and other equipment to remove all evidence of weaponization activities.

40. It was again stated that several designs of the implosion type were envisaged, but that serious consideration had not been given to the gun type. The main calculation effort was explained to have been based on open literature codes, adapted locally to the specific problems and constants (including equations of state and constitutive models) for implosion systems. These codes had been run on an NEC 750 computer located at Tuwaitha, and after the Gulf war this computer was moved to the National Computer Centre where it has been inspected by IAEA teams. Some indigenous codes were also developed and operated on personal computers.

41. Many experiments in the field of shock waves and high-explosives science were said to have been carried out, mainly at the Site 100 bunker at Al Atheer. It was, however, stated several times that shock tests or hydro tests involving uranium had never been carried out at Al Atheer. A 32-point electronic firing system developed by the Fourth Group using detonators developed by Al Qaqaa was tested and was said to have given satisfactory results. Flash X-ray systems (180, 600 and 1200 kV) and two gas guns (light gas and high-explosive-driven

gas) were under development as future high-pressure ionization sensors and fibre optics was used with fast response electronic equipment and high speed electronic streak cameras.

42. During discussions, held in conjunction with the inspection visit to Al Atheer, a more credible description of the activities intended to be carried out in the principal buildings was given. The Iraqi counterparts declared that their previously maintained statement that Al Atheer buildings 101, 33, 21, 19, 18 and 14 (see annex II) all belonged to the Hatteen State establishment was not true and stated that the Al Atheer facility, including the so-called Hatteen area, had been designed as an integral facility for the research, development and production of nuclear weapons, as assessed by the team of the fourth and seventh IAEA inspection missions. Clarification was also given about the actual activities carried out in some of the buildings which had been available for use in 1990. Practical assessment of this information is now precluded as a result of the destruction, during 1992, of the technically significant buildings and items of equipment as part of the IAEA mandate under resolution 687 (1991).

43. In the area of neutron initiators, several different approaches were said to have been studied for internal (cylindrical, as previously declared, and spherical) and external neutron sources. It was stated that experimental activity, in connection with the initiator development, had included the production and recovery of tritium through the irradiation of lithium, the production and recovery of polonium through the irradiation of bismuth and the plating of polonium.

44. A visit to Tuwaitha and Al Shakili allowed the inspectors to discuss additional details and inspect some equipment related to neutron sources, particularly the dense plasma focus system (DPF) studied by the Fourth Group.

45. The Iraqi counterpart explained that design and development of the delivery system had not progressed beyond the stage of preliminary consideration but that the most probable system would have been missile-based. The Fourth Group leadership was however of the opinion that considerable further development would have been needed in the weapon design to make its weight and volume compatible with the assumed missile requirements. The study of an underground nuclear explosion was also stated to be at a preliminary stage, although it had been established - not surprisingly - that the test site would most likely have been located in the south-west of Iraq. 6/

46. A unit in the Al Qaqaa State Establishment was specially created to support the Fourth Group of the research, development, design and manufacturing of the high-explosive lenses and detonators needed for the implosion device. This group was working to develop several manufacturing processes such as rigid die-pressing of mixed explosives and plastic-bonded explosives, atmospheric and vacuum casting of melt-cast explosives and casting of explosive/polymer composites. At the end of 1990, capabilities for the computer numerical controlled (CNC) machining of high explosives had been established. The quality control of the production was mainly based on density and detonation velocity measurements.

47. The Iraqi counterparts clarified that the Al Qaqaa team had not only been responsible for the manufacture of explosives but had also been responsible for the design, development and production of the plane wave lenses, which were previously declared to have been a function of the Fourth Group and, at that time, claimed to have been at a very preliminary stage of development. It was stated that many plane wave lenses had been produced during 1990, with various diameters (up to 120 mm) and lengths and had been tested or used as plane wave generators for material shock-wave experiments.

48. The work on spherical lenses was explained to have started as early as 1988, and had used various kinds of explosives, including Baratol, PETN, COM-B, TNT, RDX and HMX. Up to May 1990, this work was declared to have been only loosely coordinated with PC-3 activities, but then close cooperation between the Fourth Group, at Al Atheer, and the unit at Al Qaqaa was established in order to consolidate their joint efforts. The experimental unit of the Fourth Group made several, single unit tests of spherical wave lenses fabricated at Al Qaqaa and concluded, at the end of 1990, that they were satisfactory, an assessment apparently not shared by the theorists. All of the explosive lenses tested were stated top have been formed by mechanical pressing; no machining of the lenses had been done.

49. The Al Qaqaa team mastered the design of dedicated exploding bridge wire (EBW) detonators, after designing several types of detonators.

50. Many areas involved in weaponization activities at Al Qaqaa were inspected. The area that was under construction at the end of 1990 and had been declared as a new quality control area for the whole of Al Qaqaa during previous inspections was acknowledged to be the area dedicated to the production of explosive lenses and had been assessed as such during the IAEA seventh inspection mission. It was acknowledged that the design of the facility and its equipment and instrumentation had relied heavily on foreign involvement. Weaponization-specific equipment, which had already been installed in several areas of the Al Qaqaa complex and used for the weaponization-related activities, was reportedly removed at the beginning of 1991.

51. The inspection team had available a number of documents from the Halder house cache that related to Al Qaqaa activities. A number of significant technical documents relating to the former nuclear weapons programmes were provided to the IAEA team by the Iraqi counterparts in the course of the inspection mission although, in some cases, the hand-over was inexplicably delayed towards the end of the inspection mission. These documents, one of which described nuclear weapon design options, are being translated to facilitate urgent detailed evaluation.

VI. CONCLUSIONS

52. As the experience with Iraq has demonstrated, it is clear that a non-compliant signatory of the Treaty on the Non-Proliferation of Nuclear Weapons could develop weaponization capabilities so as to be able, in a relatively short time-scale, to utilize special nuclear material diverted from IAEA safeguards in nuclear explosive devices. Indeed it is this assumption that

is the basis of the long-established timeliness goals of the Safeguards System. It seems that the threat of the Gulf war prompted Iraq, in August/September 1990, to embark upon this strategy before its weaponization capabilities were adequately developed such that the "time-scale" to produce a single nuclear weapon/device would have been, according to the Iraqi counterparts, at least one year and possibly extending into 1992. 7/

53. Although it is clear that some components of Iraq's nuclear weapons programme were accelerated as a result of the crash programme, there are no indications that the indigenous projects for the production of a sufficient amount of HEU required to achieve Iraq's presumed goal of assembling a small arsenal of nuclear weapons had progressed further than previously assessed.

54. There are no indications to suggest that Iraq has retained any practical indigenous capability to produce weapons-usable nuclear material. However, had the crash programme been implemented, it could have provided enough material for a nuclear device in a shorter time than would have been necessary through Iraq's covert programme to enrich natural uranium. It is recognized that Iraq's intellectual capabilities and resources in this regard remain.

55. There is a need for Iraq to issue a further revision to the June 1992 issue of the so-called full, final and complete declaration. The revised declaration must provide a comprehensive description of all facets of the past programme in particular the work of the 1987 nuclear weapons study group at the Ministry of Industry and Military Industrialization and the "crash programme", including the programme milestones and deadlines and the military strategy. It must also include details of the various procurement networks, the achievements of the Fourth Group, work on other enrichment technologies, the handling, processing and use of non-declared nuclear material, work on radiological weapons and activities since the end of 1990. Information should also be provided on the present location(s) of materials, equipment and documents removed after April 1991 from the Engineering Design Centre (Rashdiya) by the Special Guards of the Iraqi army.

56. Iraq's crash programme to extract weapons-usable material from the safeguarded research reactor fuel constitutes an additional violation of its Safeguards Agreement with IAEA, and its failure, until now, to declare this programme and other related activities and to surrender to IAEA all nuclear-related materials and documents constitutes a violation of Iraq's obligations under Security Council resolutions.

Notes

1/ On 20 August, the Chairman of the United Nations Special Commission, who was also present in Iraq in response to a similar invitation from the Government of Iraq, was advised of Iraq's discovery of a cache of documents, materials and fabricated items, relating to weapons of mass destruction, which had been concealed on property belonging to the family of General Hussein Kamel. This cache, referred to as the Halder house farm cache, which was placed in UNSCOM/IAEA custody in Baghdad has been catalogued and characterized and the portion relating to Iraq's clandestine nuclear weapons programme, including

almost a million pages of documentation, has been transferred to IAEA headquarters, where analysis is in progress.

2/ This statement was eventually offered by Dr. Jaffar in response to questions as to the wisdom of proceeding with this stage of the crash programme and thus alerting the international community before sufficient work had been done to guarantee success from the other stages of the crash programme.

3/ It is relevant to note that all of the critical, high precision, components of the centrifuge machines, including the rotors, end caps, scoops and bearing magnets, although assembled at the Engineering Design Centre, had been procured abroad.

4/ Construction of this building was commenced but never progressed beyond the foundations, support pillars and the partial construction of some of the walls.

5/ The time to completion of a weapon/device was further reduced during the continued discussions in IAEA-29.

6/ It was already foreseen that a more detailed assessment of the status of these two aspects would need to be undertaken in the next inspection mission, IAEA-29.

7/ This time-scale, which already constituted a revision to the three-to-four-year time-scale suggested during the August talks, was further reduced during IAEA-29.

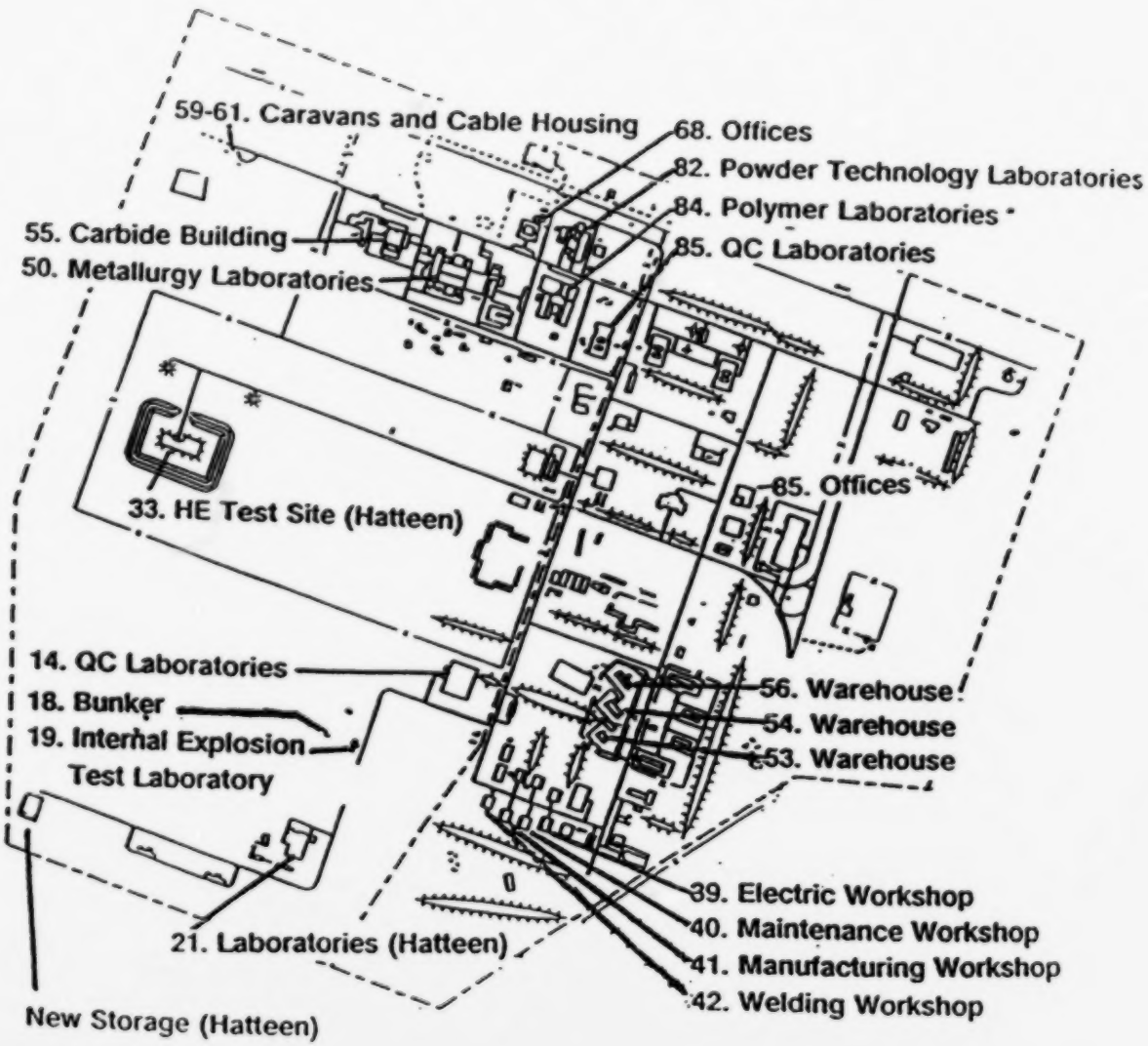
Annex I

List of facilities, installations and sites inspected in IAEA-28

1. The Engineering Design Centre (Rashdiya)
2. Al Atheer
3. Al Qaqaa
4. Tuwaitha, including Al Shakili
5. Project 1200 (South Taji)

Annex II

Al Atheer site plan



Annex III

Revised nuclear material flow chart
as of 18 September 1995